COMPARISON OF CLAIMS OF APPLICATION 10/541,059
WITH CLAIMS OF EXCEM APPLICATION NO. 10/547,083

1. A method for transmitting through an interconnection with *n* transmission conductors and a reference conductor, *n* being an integer greater than or equal to 2, the method providing, in a known frequency band, *m* transmission channels each corresponding to a signal to be sent from the input of at least one transmitting circuit to the output of at least one receiving circuit, where *m* is an integer greater than or equal to 2 and less than or equal to *n*, the method comprising the steps of:

- modeling the interconnection, taking into account the lumped impedances seen by the interconnection and caused by the circuits connected to the interconnection elsewhere than at the ends of the interconnection, as a multiconductor transmission line having uniform electrical characteristics over its length for the known frequency band;

- determining, for the multiconductor transmission line and the known frequency band, the characteristic impedance matrix and a transition matrix from modal electrical variables to natural electrical variables;

- placing at at least one end of the interconnection, a termination circuit having an impedance matrix approximating the characteristic impedance matrix;

- combining the *m* input signals in one of the transmitting circuits[~~without using a transformer for this purpose~~], according to linear combinations defined by the transition matrix from modal electrical variables to natural electrical variables**, using a digital processing and a conversion of the digital signals 2 produced by the digital processing into n analog signals**, so as to obtain at the output of said one of the transmitting circuits, output being connected to the *n* transmission conductors, the generation of modal electrical variables, each being proportional to a single signal among the input signals; and

- combining in one of the receiving circuits, the input of which is connected to the *n* transmission conductors, [~~without using a transformer for this purpose,~~]the **analog** signals present on the transmission conductors, according to linear combinations defined by the inverse of the transition matrix from modal electrical

variables to natural electrical variables, **using a conversion of the *n* analog signals into digital signals and a digital processing of the digital signals produced by the conversion**, so as to obtain at the output of said one of the receiving circuits *m* output signals each corresponding to one of the transmission channels, each output signal being proportional to a single modal electrical variable among the modal electrical variables.

2. [~~The method of claim 1, wherein the generation of *m* modal electrical variables is obtained at the output of a transmitting circuit.~~]

[~~3. The method of any of the previous claims, wherein the number *m* of transmission channels between any one of the transmitting circuits and any one of the receiving circuits is equal to the number *n* of transmission conductors.~~]

[~~4. The method of any of the previous claims, wherein the electrical variables are either all voltages or all currents.~~]

[~~5. The method of any of the previous claims, wherein the section of the interconnection in a plan orthogonal to the direction of propagation does not change, except for a scale factor, over the greatest part of the length of the interconnection, in the vicinity of the transmission conductors.~~]

[~~6. The method of any of the previous claims, wherein *n* is greater than or equal to three.~~]

[~~7. The method of any of the previous claims, wherein the known frequency band contains frequencies ranging from 100 kHz to 100 GHz.~~][~~8.~~]A device for proportioning the circuits used in a method for transmitting through an interconnection with *n* transmission conductors and a reference conductor, *n* being an integer greater than or equal to 2, the method providing, in a known frequency band, *m* transmission channels each corresponding to a signal to be sent from the input of at least one transmitting circuit to the output of at least one receiving circuit, where *m* is an integer greater than or equal to [~~2~~-]and less than or equal to *n*, the device comprising:

- means for modeling the interconnection, taking into account the lumped impedances seen by the interconnection and caused by the circuits connected to the interconnection elsewhere than at the ends of the interconnection, as a multiconductor transmission line having uniform electrical characteristics over its length for the known frequency band;

- means for determining, for the multiconductor transmission line and the known frequency band, the characteristic impedance matrix and a transition matrix from modal electrical variables to natural electrical variables;

- means for proportioning a termination circuit having an impedance matrix approximating the characteristic impedance matrix;

- means for proportioning one of the transmitting circuits which combines the *m* input signals, [~~without using a transformer for this purpose,~~]according to linear combinations defined by the transition matrix from modal electrical variables to natural electrical variables**, using a digital processing and a conversion of the digital signals produced by the digital processing into *n* analog signals**, so as to obtain at the output of said one of the transmitting circuits, output being connected to the *n* transmission conductors, the generation of modal electrical variables, each being proportional to a single signal among the input signals; and

- means for proportioning one of the receiving circuits, the input of which is connected to the *n* transmission conductors, which combines, [~~without using a transformer for this purpose,~~]the **analog** signals present on the transmission conductors, according to linear combinations defined by the inverse of the transition matrix from modal electrical variables to natural electrical variables**, using a conversion of the n analog signals into digital signals and a digital processing of the digital signals produced by the conversion**, so as to obtain at the output of said one of the receiving circuits *m* output signals each corresponding to one of the transmission channels, each output signal being proportional to a single modal electrical variable among the modal electrical variables.

[~~9.~~]**3.** The device of claim [~~8~~]**2,** wherein the means for modeling the interconnection comprise means for measuring and/or for computing the real electrical characteristics of the interconnection, based on the relative layout of the transmission conductors and the reference conductor, and on the characteristics of the dielectrics surrounding them.

[~~10.~~]**4.** The device of [~~any of the claims 8 or 9~~]**claim 2,** wherein the means for modeling the interconnection comprise:

- means for calculating one or more error coefficients for variance between the actual electrical characteristics of the interconnection and the desired characteristics, for the known frequency band; and

- means for optimizing the relative position of the transmission conductors by minimizing the error coefficients or coefficients.

5. The device of claim 2, wherein the means for proportioning one of the transmitting circuits and the means for proportioning one of the receiving circuits take into account the errors related to sampling, quantization and any approximations used to define the digital processing of the transmitting circuits and of the receiving circuits.

[~~11.~~]**6.** A device for transmission providing, in a known frequency band, *m* transmission channels each corresponding to a signal to be sent from the input of at least one transmitting circuit to the output of at least one receiving circuit, where *m* is an integer greater than or equal to 2, the device comprising:

- an interconnection with *n* transmission conductors and a reference conductor, *n* being an integer greater than or equal to *m*, the interconnection being proportioned in such a way that the interconnection may, taking into account the lumped impedances seen by the interconnection and caused by the circuits connected to the interconnection elsewhere than at the ends of the interconnection, be modeled as a multiconductor transmission line having uniform electrical characteristics over its length for the known frequency band;

- one or two termination circuits, each arranged at one end of the interconnection and each having, in the known frequency band, an impedance matrix approximating the characteristic impedance matrix of the multiconductor transmission line, the termination circuits, if there are several termination circuits, being each arranged at a different end of the interconnection;

- at least one of the transmitting circuits for combining the *m* input signals, [~~without using a transformer for this purpose,~~]according to linear combinations defined by a transition matrix from modal electrical variables to natural electrical variables**, using a digital processing and a conversion of the digital signals produced by the digital processing into n analog signals**, in order to obtain at the output of said one of the transmitting circuits, output being connected to the *n*

transmission conductors, the generation of modal electrical variables, each being proportional to a single signal among the input signals; and

- at least one of the receiving circuits, the input of which is connected to the *n* transmission conductors, for combining[~~, without using a transformer for this purpose,~~] the **analog** signals present on the transmission conductors, according to linear combinations defined by the inverse of the transition matrix from modal electrical variables to natural electrical variables**, using a conversion of the n analog signals into digital signals and a digital processing of the digital signals produced by the conversion**, so as to obtain at the output of said one of the receiving circuits *m* output signals each corresponding to one of the transmission channels, each output signal being proportional to a single modal electrical variable among the modal electrical variables.

[~~12.~~]**7.** The device of claim [~~11~~]**6,** where the generation of *m* modal electrical variables is obtained at the output of a transmitting circuit.

[~~13.~~]**8.** The device of [~~any of the claims 11 or 12~~]**claim 6,** wherein the number *m* of transmission channels between any one of the transmitting circuits and any one of the receiving circuits is equal to the number *n* transmission conductors.

[~~14.~~]**9.** The device of [~~any of the claims 11 to 13~~]**claim 6,** wherein the section of the interconnection in a [~~plan~~]**plane** orthogonal to the direction of propagation does not change, except for a scale factor, over the greatest part of the length of the interconnection, in the vicinity of the transmission conductors.

[~~15.~~]**10.** The device of [~~any of the claims 11 to 14, wherein *n* is greater than or equal to three.~~][~~16. The device of any of the claims 11 to 15,~~]**claim 6,** wherein the termination circuit(s) is(are) made of a network of resistors.

[~~17.~~]**11.** The device of [~~any of the claims 11 to 16,~~]**claim 6,** wherein the transmitting circuit(s) and the receiving circuit(s) are connected in parallel to the interconnection, and wherein the interconnection sees a high impedance in the connections of the transmitting circuit(s) and the receiving circuit(s).

[~~18.~~]**12.** The device of [~~any of the claims 11 to 17, wherein one or more items to be interconnected contains a~~]**claim 6, wherein, in at least one of the** transmitting [~~circuit~~]**circuits** and/or [~~a receiving circuit, intended for interconnections with predetermined~~

~~characteristics.~~][~~19. The device of any of the claims 11 to 18, wherein the transmission channels are used to send digital signals.~~]**one of the receiving circuits, different delays are implemented for the different transmission channels.**

13. The device of claim 6, wherein an equalization reducing the effects of the distortions caused by propagation is implemented in the digital processing of at least one of the transmitting circuits and/or one of the receiving circuits, on one or more transmission channels.

14. The device of claim 6, wherein a digital processing including an adaptive equalization for one or more transmission channels is implemented in at least one of the receiving circuits.

15. The device of claim 6, wherein the digital processing performed in at least one transmitting circuit and/or the digital processing performed in at least one receiving circuit is defined by a program.

[~~20.~~]**16.** The device of claim [~~19,~~]**6,** wherein the interconnection is operated as a data bus.